

CHAPTER III — RESEARCH SUMMARY

1. GENERAL

In past years, technical notes summarizing research studies made by the JTWC personnel were included in the Annual Typhoon Reports (ATRs). In this and future ATRs, however, only brief synopses of these studies will be given. The complete studies will be published separately as FLEWEACEN/JTWC Technical Notes. It is felt that this procedure offers several advantages. First, it allows the administrative workload associated with publication preparation to be distributed throughout the year rather than concentrated within a few months during preparation of the ATR. Second, it allows authors to include more technical details of their studies than would be appropriate for inclusion in the ATR.

2. INVESTIGATION OF GUST FACTORS IN TROPICAL CYCLONES

(Reference: Atkinson, G.D., FLEWEACEN/JTWC Technical Note 74-1).

The 1972 Tropical Cyclone Conference requested that FLEWEACEN/JTWC include peak gusts in the warnings when sustained surface wind speeds equal or exceed 50 kts. During 1972, a sustained wind/peak gust graph derived by former JTWC personnel was used. Details on how this graph was derived were not available and there was a general feeling among JTWC forecasters that the gust factors derived from this graph were too high for open water conditions. Therefore, at the 1973 Tropical Cyclone Conference, FLEWEACEN/JTWC requested that all 7th Fleet ships equipped with anemometers include peak gusts as well as sustained winds in their weather reports during strong wind conditions. These ship observations and a comprehensive literature survey led to the derivation of a new sustained wind/peak gust relationship which was introduced into operational use by the JTWC during the 1973 season. This study showed that for strong wind conditions, gust factors (i.e., ratio of peak gusts to one-minute average sustained wind speeds) over open water should fall in the range of 1.20 to 1.25. Based on these results, the sustained wind/peak gust relationships shown in Table 3-1 are now used operationally by the JTWC.

TABLE 3-1. JTWC SUSTAINED 1-MINUTE WIND-PEAK GUST (KNOTS) RELATIONSHIPS

WIND(GUST)	WIND(GUST)	WIND(GUST)
50(65)	95(115)	140(170)
55(70)	100(125)	145(175)
60(75)	105(130)	150(180)
65(80)	110(135)	155(190)
70(85)	115(140)	160(195)
75(90)	120(145)	165(200)
80(100)	125(150)	170(205)
85(105)	130(160)	175(210)
90(110)	135(165)	180(220)

3. INTENSITY FORECASTING USING THE TYFOON ANALOG COMPUTER PROGRAM

(Reference: Craiglow, L.H., Jr., FLEWEACEN/JTWC Technical Note 74-2).

The computerized TYFOON analog program has been used by the JTWC as an aid in forecasting tropical cyclone movement since 1970. This study investigated the usefulness of the TYFOON program for forecasting tropical cyclone intensities at 24-, 48-, and 72-hours. It modified and extended a previous study on this subject by former JTWC personnel. Three parameters which are available on the basic climatological data tape used in the TYFOON program were selected to determine their usefulness in intensity forecasting. These are the minimum sea level pressure, the 12-hour change in minimum sea level pressure, and the maximum sustained surface wind speed. Based on selected values of these criteria, current and analog tropical cyclones were separated into two classes (deepening or weakening) and analog forecasts were computed. During the testing, several changes were made to the classification criteria to obtain better results. Also, it was determined that intensity forecasts computed independently for the various time periods were not consistent. Therefore, the program was modified so that each succeeding intensity forecast used the previous intensity forecast as an input, i.e., initial conditions for the 48-hour forecast would depend on the 24-hour forecast, etc. Verification results based on selected cases from the 1972 tropical cyclone season showed the analog program produced intensity forecasts that were slightly better than the official JTWC forecasts for the 24-hour period but were slightly worse than the official forecasts at 48 and 72 hours. Nevertheless, these preliminary results indicate that further testing of this program is warranted to provide another objective forecast aid to JTWC forecasts.

4. EVALUATION OF THE EXTRAPOLATION FEATURE OF THE TYFOON ANALOG COMPUTER PROGRAM

(Reference: Craiglow, L.H., Jr., FLEWEACEN/JTWC Technical Note 74-3).

The original version of the TYFOON analog program, first used operationally by the JTWC in 1970 has been modified several times to improve its performance. In the TYFOON-72 version of the program, if a selected analog storm had insufficient positions to provide a forecast out to 72 hours, the program extrapolated up to four additional six-hourly positions. This extrapolation feature was necessary because of premature termination of many tropical cyclones on the original data tape (1945-1969). During 1972, tropical cyclone data for 1970 and 1971 were added to the basic climatological data tape and tracks for all tropical cyclones for the entire period of record (1945-1971) were extended. These modifications to the data tape and reductions of the basic time interval for selection of analog cases from ± 50 days to ± 35 days resulted in the version of the TYFOON

program known as TYFN 73. Since the original tropical cyclone tracks were subsequently extended, it was felt that the extrapolation feature of TYFOON-72 was no longer required. To test this hypothesis, 15 cases from 1972 were selected and 24-, 48-, and 72-hour position forecasts were prepared using both TYFOON-72 and TYFN 73. The overall results showed the average forecast errors for TYFN 73 were slightly lower than TYFOON-72 at all time periods. The most significant fact, however, was that TYFN 73 required 46% less computer time on the average than TYFOON-72. Considering that the JTWC requires hundreds of analog forecasts each year, the savings in computer time will be significant. The JTWC will use the TYFN 73 version of the analog program during the 1974 tropical cyclone season.

5. A COMPARISON OF THE SENSITIVITY OF TWO SIMILAR OBJECTIVE FORECAST TECHNIQUES

(Reference: Craiglow, L.H., Jr., FLEWEACEN/JTWC Technical Note 74-4).

A number of computerized objective forecast techniques are available to assist the JTWC in the preparation of warnings. Of concern is the sensitivity of these techniques to errors in the warning and history positions. Two techniques, TSGLOB, developed by FLEWEACEN Pearl Harbor, and its successor, TYMOD, developed by FLEWEACEN/JTWC Guam, were chosen for testing. Both techniques utilize the 24-hour global band upper air progs (GBUA) provided by FLENUMWEACEN Monterey. The 03/0000 GMT January 1973 GBUA fields were chosen and a control forecast for each technique was run on Guam's CDC 3100 computer. Errors of six and 12nm were introduced into the warning and history positions, both individually and collectively. Thirty-six cases were run for TYMOD and 20 for TSGLOB the difference being due to TYMOD having a 24-hour history position. The results showed that TYMOD was less sensitive to positioning errors than TSGLOB. In addition, the TYMOD errors tended to reach a maximum about +48 hours and then decrease in magnitude thereafter. Finally, the test results suggest that as much as 30% of the 24-hour forecast error may be caused by warning position errors.

6. INTERANNUAL VARIABILITY OF RAINFALL AND TROPICAL CYCLONE ACTIVITY IN THE WESTERN NORTH PACIFIC

(Reference: Pratte, J.F., FLEWEACEN/JTWC Technical Note 74-5).

In this study, rainfall amounts at various stations in the tropical North Pacific during the dry season (January-April) were correlated with the number of tropical cyclones occurring in the western North Pacific area during the same year. The period of record used was 1959-1973. This period was selected because the JTWC was established in 1959 and satellite coverage of the tropics was available for most of this period. Therefore, it was felt that statistics on the number of tropical cyclones would be highly reliable for this recent period. Correlations were made for each rainfall station individually and for various groups of stations. Results indicate that the best correlation was shown with rainfall on Guam (average of three Guam stations), however, the relationship was poor (correlation coefficient of 0.24) and not sufficient for long-range forecasting purposes. The study also provides a survey of various articles relating tropical circulation patterns and rainfall to sea surface temperature anomalies and other large scale influences.